# Science standards Grade 10

## Advanced level

## Scientific enquiry

By the end of Grade 10, students identify, develop, and make predictions related to a clearly focused research question. They control variables, work as a team and use appropriate equipment and materials. They evaluate experimental design, identify weaknesses and develop realistic strategies for improvement, and work in an ethical manner. Students know how scientists disseminate their ideas, understand the historical development of major ideas and balance the opportunities of science against its environmental threats. They record and process raw data appropriately and draw valid conclusions allowing for errors and uncertainties. They handle equipment competently with due regard to safety. They follow instructions accurately but are able adapt to unforeseen circumstances.

### Students should:

#### 1 Use methods of scientific investigation

1.1 Identify and develop a clearly focused research question.

Investigate the effect of pH on rate of enzyme action.

Investigate variability of height and foot size and links between them.

Investigate particulate deposition from the atmosphere.

Determine the acceleration due to gravity.

Devise a way of comparing the hardness of aluminium with the hardness of some of its alloys.

1.2 Make predictions directly related to a research question.

Predict the structure of biological molecules from their properties.

Predict the properties of a metal from its position in the reactivity series.

Predict the characteristic properties of an element based on its position in the periodic table.

1.3 Identify and control variables.

Determine the effect of temperature on enzyme action.

Determine factors affecting rates of reaction.

1.4 Work constructively and adaptively with others as a team on a scientific investigation.

Determine trends in national statistics medical disorders.

1.5 Evaluate experimental design, identify weaknesses and develop realistic strategies for improvement.

Design and evaluate an experiment to determine the constituents of foodstuffs.

Compare the influence of pH and temperature on enzyme action.

Minimise heat losses during the measurement of heat lost or gained during a reaction.

Assess accuracy and precision when making physical measurements.

Improve the accuracy of the measurement of the acceleration due to gravity.

Make and test a model thermostat from a bimetallic strip.

Make and test an electric motor.

1.6 Work in an ethical manner with regard to acknowledging data sources and authenticity of results.

Report on library and Internet studies with due acknowledgement to the original author.

1.7 Work in an ethical manner with regard to living things and the environment.

Minimise environmental damage during field excursions.

1.8 Identify, and make critical use of, secondary information.

Use WHO sources to determine incidences of diseases in various regions of the world.

Study the changes in atmospheric carbon dioxide concentration and mean Earth surface temperature over time.

#### 2 Know how scientists work

2.1 Understand the historical development of the major scientific ideas.

Study the historical development of the understanding of micro-organisms.

Role-play situations to illustrate changing conceptions of disease.

Chart the changes in the techniques used to extract metals from their ores from earliest times to the present day.

Show how empirical work on the classification of elements by Mendeleev was later explained by the electronic structure of the elements.

2.2 Know how scientists disseminate their ideas and results to encourage discussion and further development.

Download from the Internet, and study, key original papers (e.g. the papers by Rutherford and others on alpha particle scattering and by Watson and Crick on the structure of DNA).

Hold a class conference to share and discuss experimental results.

Check the news for reports of advances in science.

2.3 Know that science can bring great advantages to humanity but can also cause considerable damage to the environment.

Discuss the role of the carbon cycle in relation to the generation of carbon dioxide by industrial processes.

Debate the benefits and the environmental impact of some of the industrial processes covered in section 17, particularly those that are established in Qatar.

Discuss the threats to the environment posed by our frequent disposal of waste gases into the atmosphere, as noted in section 21.

#### 3 Process and communicate information

3.1 Record raw data appropriately in a manner that allows easy interpretation.

Produce charts to show the results of tests on foodstuffs.

Tabulate results of comparative experiments down groups and across periods in the periodic table.

Show the difference between several ohmic and non-ohmic conductors graphically on the same V/I graph.

3.2 Process raw data by the most appropriate means.

Calculate the mean and range of the hand spans of students of different age.

Show graphically the pH change during neutralisation.

Process graphically data on velocity and acceleration.

3.3 Draw valid conclusions, allowing for errors and uncertainties.

From experimental testing of samples of DNA decide which matches a given profile.

Arrange metals in order of reactivity based on experimental results.

3.4 Use an appropriate range of methods to communicate scientific information.

Produce wall charts to illustrate the replication of DNA.

Create a radio documentary on the nitrogen cycle.

Use ICT to create displays of dynamic processes (e.g. electron migration during a chemical reaction).

Make models to show complex three-dimensional molecular structures (e.g. diamond, graphite and fullerene).

Use flow charts to summarise industrial and biological processes.

#### 4 Handle equipment and make measurements

4.1 Select and use correctly and competently the appropriate equipment and materials for an investigation, with due regard for the safety of self and others.

Use an appropriate microscope and magnification to study cells and cell structures.

Use chromatography and electrophoresis apparatus.

Use an oscilloscope to study sound waves.

Use optical equipment safely.

4.2 Follow instructions accurately but be able to adapt to unforeseen circumstances.

For Grade 10, advanced level, the weightings of the assessment objectives to be applied to each content strand are as follows:

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| --- | --- | --- | --- |
|  | Knowledge and understanding | Application, analysis and evaluation | Scientific enquiry skills and procedures |
| Assessment weighting | 45 to 55% | 25 to 35% | 20 to 25% |